Storm Water Source Control Completion Report Terminal 4 Slip 1 and Slip 3 Upland Facilities Portland, Oregon

Prepared for:
Port of Portland

September 28, 2011
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Environmental and Geotechnical Consultants

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Acronyms and Abbreviations

Ash Creek	Ash Creek Associates, Inc.
Anchor	Anchor Environmental, L.L.C.
BBL	Blasland, Bouck & Lee
BMPs	Best Management Practices
CAS	Columbia Analytical Services
City	City of Portland, Oregon
COI	Constituents of Interest
COPC	Constituent of Potential Concern
DEQ	Oregon Department of Environmental Quality
DOC	Dissolved Organic Carbon
EE/CA	Engineering Evaluation/Cost Analysis
EPA	U.S. Environmental Protection Agency
Facilities	Terminal 4 Slip 1 and Slip 3 Uplands
Integral	Integral Consulting, Inc.
JSCS	Joint Source Control Strategy
LWG	Lower Willamette Group
µg/kg	Micrograms per Kilogram
µg/L	Micrograms per Liter
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MRL	Method Reporting Limit
MSL	Mean Sea Level
MS4	Municipal Separate Storm Sewer System
ng/kg	Nanogram per Kilogram
NPDES	National Pollutant Discharge Elimination System
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEC	Probable Effects Concentration
PHSS	Portland Harbor Superfund Site
Port	Port of Portland
POTW	Publicly Owned Treatment Works
PSEP	Puget Sound Estuary Protocol
QA/QC	Quality Assurance/Quality Control
RI	Remedial Investigation
SLV	Screening Level Value
Stormfilter®	Stormfilter® Treatment System
SW DSR	Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities
SWE WP	Storm Water Evaluation Work Plan, Terminal 4 Slip 1 and Slip 3 Upland Facilities

SWMP	Storm Water Management Plan
SWSCE	Storm Water Source Control Evaluation
T4 FSPR	Field Sampling Procedures Report
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSS	Total Suspended Solids

1.0 Introduction

This report documents the Storm Water Source Control Measures (SCMs) and subsequent storm water sampling completed at the Port of Portland (Port) Terminal 4 Slip 1 and Slip 3 Upland Facilities in Portland, Oregon (the Facilities). The SCM activities are required by the Oregon Department of Environmental Quality (DEQ), pursuant to the following:

- Terminal 4 Slip 1 Upland Facility – Voluntary Agreement for Remedial Investigation, Source Control Measures, and Feasibility Study (DEQ No. LQVC-NWR-03-18), December 4, 2003.
- Terminal 4 Slip 3 Upland Facility – Consent Judgment No. 0410-10234, Multnomah Circuit Court, October 7, 2004, Section 3.C.

The storm water conveyance line cleanout SCMs were conducted in general accordance with the DEQ-approved Storm Water Source Control Evaluation (SWSCE) dated September 2009. DEQ commented on the SWSCE in a letter dated December 14, 2009. A response to DEQ comments was submitted by the Port in a letter dated January 29, 2010. The DEQ approved the SWSCE and Port comments in a letter dated March 5, 2010. Storm water sampling was conducted between October 2010 and May 2011 to assess the storm water conditions following the SCMs. Also included in this report are the results of storm water sampling conducted following tank demolition activities at the Facilities to assess whether the demolition activities impacted storm water.

1.1 Document Organization

This document presents the evaluation of storm water data collected in 2010 and 2011 following implementation of SCMs proposed in the SWSCE and subsequent communication with the DEQ. This document is organized as follows:

- Section 2 provides a background of the Facilities, storm water drainage system, and storm water controls currently in place.
- Section 3 is an overview of the 2006 through 2008 storm water and storm water solids sampling program, sampling results, and source control evaluation results.
- Section 4 documents the procedures of the storm water conveyance line cleanouts, conducted as an SCM.
- Section 5 presents the 2010/2011 storm water sampling program procedures and analytical program.
- Section 6 presents the storm water sampling data and evaluates the storm water data relative to the 2006 through 2008 results, Joint Source Control Strategy (JSCS) Screening Level Values (SLVs), and the storm water sampling results of other Portland Harbor Heavy Industrial (HI) Sites.

- Section 7 provides conclusions based on the analysis of the SCMs and storm water sampling results.

2.0 Background

This section describes the Facilities and storm drain system and summarizes historical storm water sampling results. Primary source documents are the Terminal 4 Slip 1 Remedial Investigation (RI) Report (Ash Creek/Newfields, 2007a), the Terminal 4 Slip 3 RI Report (Hart Crowser, 2000), the Terminal 4 Early Action Characterization Report (BBL, 2004), and the Terminal 4 Early Action Engineering Evaluation/Cost Analysis (EE/CA; BBL, 2005), as well as operations and environmental maintenance records maintained by the Port.

2.1 Facility Description

Terminal 4 comprises approximately 283 acres on the east bank of the lower Willamette River and is downstream from the St. Johns Bridge in north Portland, Oregon, between River Miles 4.1 and 4.6. The Slip 1 and Slip 3 Upland Facilities are approximately 98 acres and 23 acres in area, respectively. Figures 1 and 2 show the vicinity and layout of the Slip 1 and Slip 3 Facilities.

The topography of the Slip 1 and Slip 3 Uplands is relatively flat, with an elevation of approximately 30 feet above mean sea level (MSL). The ground surface of the Facilities is predominantly paved with asphalt or concrete, with unpaved areas of generally gravel or grass. No surface water bodies are located on the Facilities, but each is located adjacent to the Willamette River.

2.1.1 Current Facility Use

Terminal 4 has been designated as a marine facility since 1917 and is capable of ship loading and unloading, cargo handling and storage, and has equipment maintenance facilities. The terminal includes six berthing areas (Berths 401, 405, 408, and 410 through 412) that are located in Slip 1 and Slip 3. Currently, Berths 410 and 411 are the only active berthing areas. Activities at the Slip 1 Upland Facility include areas directly adjacent to Slip 3.

- **Slip 1.** The Port leases portions of Slip 1 to various industrial tenants. Current tenants include Cereal Food Processors, Inc. (Cereal Foods), Kinder Morgan Bulk Terminal (Kinder Morgan), International Raw Materials, Ltd. (IRM), and Rogers Terminal and Shipping (a division of Cargill Marine and Terminal, Inc.). Cereal Foods leases approximately 2.0 acres and associated structures at Slip 1 for a flouring mill. Kinder Morgan leases Pier 4 and its adjacent area for loading of soda ash onto ships at Berths 410 and 411. IRM leases the liquid bulk facility at Slip 1 for storing, handling, and distributing bulk liquid and granular products. Products handled by IRM have included caustic soda, non-organic fertilizer, magnesium chloride, lignin, lignon-sulfonate, molasses products, tallow, propylene glycol, and vegetable oil. Currently, IRM is handling ammonium sulfate and urea ammonium nitrate (UAN) and uses berth 408 to unload these products. Rogers Terminal and Shipping leases office space, warehouse storage, a shop, and a gearlocker.

- **Slip 3.** A portion of the Slip 3 Uplands is the Kinder Morgan soda ash operations, as detailed above. Marine Facilities Maintenance uses the gearlocker building located on the Slip 3 Uplands for storage. The remainder of Slip 3 is either used for parking associated with the Toyota Auto Storage Facility or is currently inactive.

Figure 3 shows the boundaries of the current leaseholds for the Facilities.

2.1.2 Historical Facility Use

The Port prepared a detailed discussion of the history of Terminal 4 (including the Facilities) for the EE/CA Work Plan (BBL, 2004) and EE/CA Report (BBL, May 2005). Information on Slip 1 and Slip 3 operations, former and current tenants, and substances currently or formerly handled at the Facilities are detailed in Appendix A of the EE/CA and summarized below.

The Port acquired certain property and improvements within the Terminal 4 property from the City of Portland Commission of Public Docks (City CPD) effective January 1, 1971. The City CPD purchased the property in 1917 as part of the original 117.55-acre site for the St. Johns terminal. This included approximately 36 acres of submerged land around the former Gatton Slough, which entered the river near the head of Slip 1. Development of the terminal resulted in the filling of Gatton Slough and adjacent areas within the river, and excavation of Slip 1. In 1972, the Port purchased a strip of land along the northern property line from Broadway Holding Company in connection with the relocation of the grain berth to the face of current Berth 401 (Hart Crowser, 1991).

- **Slip 1.** Operations at the Slip 1 Upland Facility during the City CPD's ownership (1917 to 1971) included: loading, unloading, and storage of grain; cold storage; fumigation of cotton and food products; liquid storage (fertilizer, molasses, tallow, urea, caustic soda, and fats); milling of grain into flour, container food freight, a gasoline station, salvage yard, operation of a break-bulk berth and fire boat moorage, and importing ore and ore concentrates, including alumina, bauxite, chromite, chrome ore, coal, ferro-phosphorous iron ore, manganese, lead concentrate, tricaphos and zinc concentrate.

  During the Port's ownership of the Slip 1 Upland Facility, tenant operations have generally included grain storage, milling grain, liquid bulk storage, pencil pitch handling, a soda ash handling facility, and storing and maintaining equipment for loading and unloading ships. The buildings at Pier 1 and Pier 2 have also been used for storage of impounded vehicles from a federal sting operation, architectural artifacts for a local historical group, importing live sheep, and for handling break-bulk cargoes such as steel coil and aluminum ingots.

- **Slip 3.** Historically, the berthing areas at Slip 3 have been used for bulk cargo loading and unloading operations. Products handled at the Slip 3 berths have included pencil pitch, petroleum products, soda ash, talc, sulfur, zinc, lead and copper ores/concentrates, bentonite clay, coal, coke, and iron briquettes. Within Slip 3, bulk operations at Berth 412 were terminated in 1989. Currently only Berths 410 and 411 are in use for handling soda ash.

2.2 Drainage Basins, Storm Water System, and Storm Water Controls

Prior to initiating the storm water sampling program, storm drain drawings were reviewed to identify existing storm drain systems and the drainage basins contributing to the drainage systems present on the Facilities as detailed in the DEQ-approved *Storm Water Evaluation Work Plan* (SWE WP; Ash Creek/Newfields, 2007b). Figure 4 shows the basins and drainage systems for the Facilities.

2.3 Storm Water Permits, BMPs, and Storm Water Controls

Storm water discharges from the Facilities are permitted under the Port's NPDES DEQ Municipal Separate Storm Sewer System (MS4) Discharge Permit No. 101314 and Kinder Morgan's individual NPDES 1200-Z Industrial Storm Water Permit No. 102446. Kinder Morgan is responsible for legal compliance under its operating agreements, including operational permits, implementation of a Spill Response Plan and a Storm Water Pollution Control Plan (SWPCP), and compliance with the Port's MS4 Discharge Permit. These permits authorize the release of storm water to the river subject to specified terms and conditions and also require the implementation of best management practices (BMPs).

2.3.1 Port BMPs

The Port has implemented numerous BMPs at Terminal 4 as part of its tenant and licensee contracts, Environmental Management System Program, and continual improvement policy. The following is a list of BMPs that are specifically related to activities conducted at Terminal 4 under the Storm Water Management Plan (SWMP) for the NPDES MS4 permit:

- Covered storage, material, and maintenance areas to reduce storm water contact area;
- Waste chemical handling, storage, and disposal procedures to prevent and control spills;
- Regular inspection, cleaning, and maintenance of all materials handling and storage areas and storm water control measures, structures, catch basins and treatment facilities to prevent blocking, accumulations, and discharge of pollutants;
- Annual cleanout of catch basins;
- Deployment and regular maintenance (annual) of catch basin inserts in the following catch basins to prevent sediment loading (Figure 5 shows the location of catch basins with inserts):
    - Basin O – Nos. 5801, 6009, 6011, 6019, 6020, 6022, 6023, and 6024;

  - Basin N – Nos. 6014, 6015, and 6017 (monthly inspection); and
  - Basin Q – Nos. 5792, 6007, 6008, 6025, 6026, 6027, 6029, 6030, 6031, 6032, 6033, and 6034;
- Annual sweeping of impervious areas exposed to storm water to remove any accumulated solids;
- During the Berth 408 Rail Yard Modernization Project, a passive storm water collection system was installed consisting of rock filter areas and perforated high density polyethylene (HDPE) pipe. Storm water is filtered by the rock areas prior to discharging to the perforated pipe, which connects to the storm water system;
- Adherence to published guidance for limiting landscape maintenance impacts to storm water;
- Implementation of a comprehensive Spill Response Program (including a reporting component that provides for immediate action to ensure appropriate and timely spill cleanup and reporting);
- Membership in the City's Regional Spill Committee and the Clean Rivers Cooperative, which are organizations committed to spill prevention and response, and the ongoing protection of maritime environments; and
- Administration of a training program for all affected personnel who play a role in the protection of storm water.

Residuals from catch basin cleanout and street sweeping are managed by the Port's Marine Facility Maintenance (MFM) personnel. Waste residuals (e.g., catch basin cleanout and street sweeping debris) are collected by MFM and consolidated with similar waste streams from other Port facilities. These wastes are subsequently profiled for waste characterization to determine appropriate treatment or disposal.

Maintenance work on the storm water conveyance system is conducted on a regular basis, including monthly inspections of storm water filtration devices/features and annual maintenance and cleaning of catch basins and drain inlets (last conducted May 2011).

The Port and its tenants implement the terms and conditions of their permits and report annually to the DEQ.

2.3.2 Storm Water Controls

In addition to BMPs employed across the Facilities, two of the storm water basins (Basins M and D) include storm water treatment systems in the conveyance system. These systems are inspected monthly.

- **Basin M Treatment System**. A Stormfilter® treatment system (Stormfilter) is installed in the conveyance system for Basin M (Figure 6). The Stormfilter was installed in 2006 as part of the Berth 408 Rail Yard Modernization Project. The Stormfilter is a large, underground, concrete vault (6 by 12 feet) which houses 11 cartridges that are filled with Metal Rx media. Metal Rx targets the following contaminants: oil and grease, soluble metals, organics, and nutrients. These are the constituents identified by the Port as most likely to be present due to operations following the expansion, and which could contribute adversely to the river (City of Portland, et al., 2006). The media works by trapping and adsorbing solids and the above pollutants. Storm runoff comes into the vault through an inlet pipe within the storm system; the vault fills via a flow spreader that disperses the water across the cartridges. The cartridges utilize siphon-actuated filtration. Once water reaches the top of the saturated filter, it drains the filtered water through the bottom of the cartridge and allows the filtered water to move out of the vault and to the outfall.

A diversion wall is installed in the conveyance line to the south of the Stormfilter vault to direct flow into the treatment system. The height of the diversion wall may potentially allow storm water flow to pass through the conveyance without being diverted into the vault and treated through the Stormfilter. Figure 6 shows the locations of the sampler, diversion wall, and Stormfilter vault.

- **Basin D Treatment System**. A Downstream Defender® system is installed in the storm water conveyance line for Basin D (Figure 7). The system was installed as a part of system upgrades during the development of this area for additional new Toyota automobile storage in 2004. The Downstream Defender® works to remove sediment and floating solids from the storm water conveyance line. The manhole identified for deployment of the sediment trap sampler and installation of the composite storm water sampler is located downgradient of a Downstream Defender®.

  Storm water is introduced tangentially into the side of the Downstream Defender®, initially spiraling around the perimeter. As the flow continues to rotate about the vertical axis, it travels downward. Low-energy vortex motion directs storm water solids toward the center and base of the vessel. Internal components at the base protect stored solids and direct the effluent up through the inner annular space.

2.4 Summary of Previous Investigations

2.4.1 Terminal 4 Removal Action Characterization and Recontamination Analysis

The Port is in the process of completing a Removal Action cleanup of sediments at Terminal 4. As part of this process, a Removal Action Characterization was completed (BBL, 2004). Extensive sediment sampling was conducted to define contaminants of potential concern (COPC) in sediments of the river. The COPC identified for Terminal 4 sediments were metals, polycyclic aromatic hydrocarbons (PAHs), bis(2-ethylhexyl)phthalate (DEHP), pesticides (DDT/DDD/DDE), and polychlorinated biphenyls (PCBs).

Storm water data have been collected as part of the preliminary Removal Action Recontamination Analysis. A Recontamination Analysis was deemed necessary to assess ongoing sources that could re-contaminate the river sediments following the removal action, including storm water. Analytical results from the initial storm water solids sampling were presented and evaluated in the Draft Recontamination Analysis Report

(BBL, 2006). The 2006 draft recontamination analysis provided the initial analysis approach to support the sediment cleanup design and identified storm water data gaps that would need to be filled to support the final analysis. The storm water data gaps identified included completion of additional storm water sampling at Terminal 4 that would be coordinated as part of the Portland Harbor Superfund Site (PHSS) (see Section 2.4.2 for further information). Based on this additional storm water characterization data and other considerations, a Sediment Recontamination Analysis Approach Report, prepared by Formation Environmental (Formation, 2010), was finalized and describes the proposed approach to assess the potential for recontamination of sediments within the Terminal 4 Removal Action area after actions have been implemented. The recontamination analysis will be completed as part of the final sediment remedy design for Terminal 4, currently scheduled after the Portland Harbor Record of Decision (ROD).

2.4.2 2006-2008 Storm Water and Storm Water Solids Sampling and Source Control Evaluation

A storm water characterization program was initiated in December 2006 and included the winter/spring 2007 storm season and the fall 2007/winter 2008 storm season. The storm water characterization program was conducted in general accordance with the DEQ-approved SWE WP dated June 2007, prepared by Ash Creek (Ash Creek/Newfields, 2007b), and the Rationale for Basin Selection for Storm Water Sampling and Additional Information Requested by DEQ in the memorandum from Ash Creek to the Port, dated February 26, 2007 (Ash Creek/Newfields, 2007c).

The Terminal 4 storm water characterization program was conducted concurrently with a storm water characterization program conducted by the Lower Willamette Group (LWG) for the PHSS Study Area under U.S. Environmental Protection Agency (EPA) oversight. Methods and procedures used in the LWG study were comparable to the Terminal 4 program so both data sets could be used to assess storm water at the PHSS. Results from the LWG study have been provided to the EPA and partner agencies, and include the Terminal 4 results (LWG's Round 3A and 3B Upland Storm Water Sampling Data Report [September 2008]).

The scope of the sampling program consisted of:

- Storm water sampling from drainage basin conveyance lines for Basins R, Q, M, L, and D. Three storm events satisfying sampling criteria were targeted for sampling during the winter/spring 2007 storm water season. The scope was subsequently increased to include an additional fall 2007 storm water event from Basins R, Q, M, L, and D, and three events from Basin D in fall 2007/winter 2008 for PCB analysis to meet LWG objectives.
- Obtaining water level and velocity information from the storm water drainage basin pipes where the composite samplers were deployed.
- Collecting storm water solids samples for analysis from four drainage basin conveyance lines (Basins R, M, L, and D) using sediment traps. Sediment traps were deployed from January 2007

through February 2008 (sample bottles were removed from approximately June through August 2007, during the non-rainy season).

The scope and additional details of the sampling program was described in the T4 Field Sampling Procedures Report (FSPR; Ash Creek/Newfields, 2009a).

The results of the storm water characterization were documented in the Storm Water Data Summary Report, Terminal 4 Slip 1 and Slip 3 Upland Facilities (SW DSR), dated March 2009 (Ash Creek, 2009b). The evaluation of the storm water and storm water solids sampling results was conducted in accordance with the JSCS guidance (DEQ/EPA, 2007) and DEQ's Guidance for Evaluating the Stormwater Pathway at Upland Sites (DEQ, 2009). The purpose of the SWSCE was to assess what, if any, storm water SCMs were needed at the Facilities. The results of the subsequent source control evaluation were presented in the SWSCE Report, submitted to the DEQ on September 9, 2009 (Ash Creek, 2009a). The storm water results from the Terminal 4 sampling were compared with the sampling results in the LWG dataset of other Portland Harbor HI Sites. The SWSCE identified a number of analytes detected in storm water and storm water solids in Terminal 4 samples at elevated concentrations than those detected in samples collected from other LWG Portland Harbor HI Sites. The majority of those exceedances were in the samples collected from Basins L and M. Therefore, the SWSCE report recommended cleanout of the storm water conveyance lines for Basins L and M in an effort to remove legacy solids from the line.

3.0 Objectives

This section summarizes the objectives and scope of work for the 2010-2011 SCMs and storm water sampling at the Facilities. The objectives and scope of work were developed based on results and conclusions in the SWSCE, discussions with the DEQ including December 14, 2009 and March 5, 2010 comment letters, and response to DEQ comments submitted on January 29, 2010.

3.1 Source Control Measures and Storm Water Sampling

As noted above, the SWSCE concluded that the storm water and storm water solids concentrations detected in samples collected from Basins L and M were outside of the range detected in the LWG dataset for a select number of analytes. The DEQ concluded in the December 14, 2009 letter that, based on comparisons with other Portland Harbor HI Sites in the entire DEQ dataset (larger than the LWG dataset), concentrations detected in samples from Terminal 4 were generally within the range of other sites with the exception of total cadmium and DEHP in storm water samples from Basin L, and PCB concentrations in storm water samples from Basins L and M. However, as shown on Figure F-11 in Appendix F, the PCB concentrations in storm water prior to the SCM appear to be within the range of concentrations at other Portland Harbor HI Sites. For storm water solids, the DEQ concluded that concentrations of cadmium, lead, zinc, DEHP and total PCBs in storm water solids samples from Basin L were elevated relative to other

Portland Harbor HI Sites. The SWSCE had previously concluded a larger number of out-of-range analytes based on the smaller LWG data set.

Because no current surface soil source of the constituents were out of range of the Portland Harbor HI Sites, legacy solids were identified as the likely cause for the exceedances. To remove legacy solids from the storm water conveyance lines, cleanouts of the storm water conveyance systems for Basins L and M were conducted in June 2010, as described in Section 4. Because Basins K and N were extrapolated from Basin L based on similar land uses, as noted in the SWE WP, the conveyance lines of Basins K and N were also cleaned out.

Following the cleanouts, three rounds of grab samples were collected from Basins L and M to evaluate the effectiveness of the line cleanouts. As Basins K and N were extrapolated from Basin L based on similar land uses, the results of the sampling of Basin L were used to evaluate the effectiveness of the cleanouts of Basins K and N. The sampling procedures and evaluation of results are discussed below in Sections 5 and 6, respectively.

3.2 Grain Tank Demolition Work and Storm Water Sampling

As documented in the Demolition Report – Terminal 4 Grain Tanks Demolition and Removal (Demolition Report) included in Appendix E of the SW DSR (Ash Creek/Newfields, 2009b), eight large above ground tanks previously used for grain storage were demolished in 2008 in the area drained by the Basin Q conveyance system. Paint containing PCBs was present on the tanks and stringent precautions were taken prior to and during the tank demolition to protect both the ground surface around the tanks and the storm water conveyance system from receiving any paint chip debris. Because the sampling of Basin Q was completed prior to the tank demolition, the DEQ requested in a December 14, 2009 comment letter that additional storm water samples be collected from Basin Q to verify that storm water has not been impacted by PCBs and that the BMPs employed during the demolition had been effective. Three rounds of samples were collected from Basin Q during the 2010/2011 storm water season. The sampling procedures and evaluation of results are discussed below in Sections 5 and 6, respectively.

4.0 Storm Water Cleanout

The conveyance lines in Basins L, M, N, and K were cleaned out to eliminate legacy solids in the storm water collection and conveyance system at the Facility as a potential source to the Willamette River. The procedures and observations of the storm water system cleanout are presented in this section. A photograph log is presented in Appendix A.

4.1 Storm Water Cleanout Approach

Terra Hydr, Inc. of Portland, Oregon completed the storm water cleanout in June 2010 (under subcontract to Ash Creek). Ash Creek personnel oversaw the field activities and completed necessary system observations and sampling.

The site-wide approach for the storm water system cleaning was as follows:

1) Each drain inlet, catch basin, manhole, and trench was opened and inspected. Drain inserts were removed. If accumulated solids were observed, the solids were collected and removed using a vacuum truck.
2) The drainage inlet, catch basin, manhole, trench, and drain line were cleaned with a high-pressure water rinse (the downstream end of the conveyance lines were temporarily blocked during the cleaning).
3) The rinsate and solids were collected via vacuum truck and transported to Cascade General for treatment and disposal.
4) Drain inserts/solids traps were re-installed where present.
5) When access was possible, roof drains were cleaned at the cleanout located closest to a downspout.

Other considerations/observations made during the cleanout included:

- The outfall from Basin L was submerged at the time of the cleanout activities. The manhole at the top of bank (before the outfall pipe runs down the riverbank) was plugged in order to conduct the cleanout of the conveyance system.
- The outfall from Basin K was submerged at the time of the cleanout activities. A “window” was cut into the outfall pipe to allow for access to install a temporary inflatable packer. Numerous 90-degree elbows were encountered in the conveyance system in this basin. The lines were cleaned from the catch basins down to a 90-degree elbow in the main line that could not be navigated. Terra Hydr attempted to jet upstream from the “window” in the outfall pipe but met similar access limitations. Approximately 30 percent of the conveyance line was cleaned by jetting. Consequently, a high volume water flush was conducted from the upper portion of the conveyance piping with capture at the bottom. The “window” in the outfall pipe was patched once the cleaning was completed.

4.2 Waste Management

In total, 11,400 gallons of rinsate were delivered to Cascade General (Appendix B). The dry solids collected during the cleanout and the settled solids were deposited into a drop box on site, pending analysis and disposal. In total, 5.59 tons of solids were disposed of at the Waste Management Hillsboro Landfill (Appendix B).

5.0 Storm Water Sampling and Analysis

Storm water sampling was completed to evaluate the effectiveness of the line cleanouts in Basins L and M. In addition, storm water samples were collected from Basin Q in response to a request from the DEQ. The methods and procedures used to complete the storm water grab sampling are presented in this section.

5.1 Sampling Event Criteria

The performance monitoring program included sampling and analysis of three qualifying storm events as follows:

1) Each sampling event is preceded by an antecedent dry period of at least 24 hours (as defined by less than 0.1 inch of precipitation over the previous 24 hours);
2) Minimum predicted rainfall volume of greater than 0.2 inch per event; and
3) Expected storm event duration of at least three hours.

A rain gauge at Terminal 4, which is maintained by the City of Portland Hydra Network, was used to determine if the sampling criteria were met. The rain gauge lists the rainfall depth per hour and is generally on a 1- to 3-hour time delay. The rain gauge data are found at the following web address: http://or.water.usgs.gov/non-usgs/bes/terminal4ne.rain.

5.1.1 Storm Events

Samples were collected from the three drainage basins and analyzed for contaminants of interest (COI). Storm water hydrographs are presented in Appendix C. The storm water sampling was completed during storms on the following dates:

October 23, 2010 Storm Event. Ash Creek personnel mobilized to Terminal 4 on the evening of October 23, 2010, to collect samples in Basins L, M, and Q. The rain gauge measured 0.59 inch of rainfall and a duration of 19 hours. There was no rainfall in the 24-hour period preceding the rain event.

November 6, 2010 Storm Event. Ash Creek personnel mobilized to Terminal 4 in the evening of November 6, 2010, to collect samples in Basins L and M. The rain gauge measured 0.72 inch of rainfall and a duration of 8 hours. There was no rainfall in the 24-hour period preceding the rain event.

February 12, 2011 Storm Event. Ash Creek personnel mobilized to Terminal 4 on the evening of February 12, 2011, to collect samples in Basins L, M, and Q. The rain gauge measured 0.56 inch of rainfall and a duration of 4 hours. There was no rainfall in the 24-hour period preceding the rain event.

May 11, 2011 Storm Event. Ash Creek personnel mobilized to Terminal 4 in the afternoon of May 11, 2011, to collect a sample in Basin Q. The rain gauge measured 0.44 inch of rainfall and a duration of six hours. There was no rainfall in the 24-hour period preceding the rain event.

5.2 Storm Water Sampling and Compositing Procedures

Storm water grab samples were obtained from the same manholes where automated composite sampling was historically conducted (Figure 8). The samples were collected following Ash Creek Standard Operating Procedure (SOP) 2.12 (Outfall Grab Water Sampling Procedures; Appendix D). For Basins L and M, decontaminated stainless steel containers were attached to a telescoping swing sampler to collect the water samples. Due to access restrictions, a peristaltic pump was used to collect the water samples from Basin Q. Water samples were collected into 1-gallon laboratory-decontaminated bulk sample containers for transport to the laboratory. Each of the 1-gallon containers collected from each basin was combined and composited at the laboratory. The laboratory subsequently transferred the composited samples into the respective sample containers for each analysis.

5.2.1 Laboratory Analysis

Following each sampling event, the samples were transported to Pace Analytical Services (Pace) in Seattle, Washington, for analysis. The samples were picked up by the laboratory courier, following chain-of-custody protocols. The PCB aroclor and congener analyses were performed by Analytical Resources, Incorporated in Tukwila, Washington, and Vista Analytical Laboratory in El Dorado Hills, California, respectively, under subcontract to Pace.

The storm water samples for were analyzed for some or all of the following analyses:

- Total Suspended Solids (TSS) by SM 2540D
- Total and Dissolved Metals (aluminum, antimony, arsenic, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc) by EPA Method 6020
- Total and Dissolved Mercury by EPA Method 7470
- Total and Dissolved PAHs by EPA Method 8270-SIM
- Total and Dissolved Phthalates by EPA Method 8270
- Total and Dissolved PCB Congeners by EPA Method 1668
- Total and Dissolved PCB Aroclors by EPA Method 8082

The samples collected from Basins L and M on October 23 and November 6, 2010, were analyzed for the analytes listed above. The samples collected from Basins L and M on February 12, 2011, were only analyzed for the total analytes listed above; no dissolved analyses were conducted (with the exception of analyses for metals and PAHs). Samples collected from Basin Q, which was sampled to evaluate whether PCBs could have impacted storm water during demolition of the Cargill grain tanks, were analyzed for total and dissolved PCB aroclors and congeners during the October 23, 2010 event and PCB aroclors for the remaining two events (February 12 and May 11, 2011).

For the dissolved analyses, the LWG filtration protocols specify a 0.2-micron filtration be used for filtration of organics and 0.45-micron filtration be used for filtration of inorganics. The analytical laboratory inadvertently conducted the filtration using the following protocol:

- A 1-micron filtration was used for both dissolved organics and inorganics for the samples collected on October 23 and November 6, 2010.
- A 1-micron filtration was used for dissolved organics for the samples collected on February 12, 2011.

The laboratory reports for the storm water sampling and a quality assurance/quality control (QA/QC) review of the laboratory data are included in Appendix E. As noted in Appendix E, the results for the samples that were not filtered correctly were rejected and are not included in the data evaluation. Tabulated analytical data are presented in Tables 1 through 6.

6.0 Evaluation of Storm Water Sampling Results

Consistent with the JSCS guidance, the 2011 storm water analytical results were compared to the SLVs in Table 3-1 of the guidance (DEQ/EPA, 2005; updated July 2007). Only the 2010/2011 storm water sampling results from Basins L, M, and Q are evaluated in this Report. The storm water sampling results for other storm water basins were previously evaluated in the SWSCE Report (Ash Creek, 2009). In addition to comparing the results to the appropriate SLVs, a comparison of the 2011 storm water analytical results with the pre-cleanout results from Basins L and M was also conducted. The Basin Q 2011 sampling results were compared with the sampling results prior to the Cargill grain tank demolition. Tables 1 through 6 present the results of the 2010/2011 storm water sampling program along with the pre-cleanout and pre-tank demolition results. Consistent with DEQ guidance, the storm water sampling results were compared with the Portland Harbor-wide HI Sites concentration plots found in Appendix E of the *DEQ Guidance for Evaluating the Stormwater Pathway at Upland Sites* (DEQ, 2010). Average values for the historical and 2010/2011 sampling results were overlaid on the DEQ storm water data plots, which are presented on figures in Appendix F.

The following sections present the results of the evaluation of constituents with SLV exceedances.

6.1 Metals

As noted above, the DEQ concluded that the pre-cleanout concentrations of metals were within the range of other Portland Harbor HI Sites, with the exception of cadmium in Basin L. Samples collected from Basins L and M on October 23 and November 6, 2010 and February 12, 2011, were analyzed for total and dissolved metals. As noted above, because the incorrect filtration procedures were used for the October 23 and November 6, 2010 events, the dissolved metals concentrations detected in those two samples are likely biased high, were rejected during the data evaluation (as discussed in Appendix E), and are not included in this evaluation

When compared with the results of the pre-cleanout sampling, nearly all of the metals saw decreases in total concentrations detected, as shown in Table 1 and on Figures F-1 through F-9. Current land uses at Basins L and M are for storage, handling, and distribution of bulk liquid and granular products (i.e., ammonium sulfate, soda ash and UAN). Based on a review of the RI data and current and historical land uses, no correlation between the metal concentrations and surface soil source is apparent.

Metals results that exceeded JSCS SLVs are presented in Table 1, along with the 2007 sampling results from the two basins. Metals with concentrations that exceed SLVs during one or more sampling event the 2010/2011 sampling are the following:

- Total and Dissolved Aluminum in Basins L and M;
- Total and Dissolved Antimony in Basin L;
- Total and Dissolved Arsenic in Basins L and M; and
- Dissolved Copper in Basins L and M.

When available, the total metals concentrations before and after the line cleanout SCM was conducted were added to the plots of the DEQ Portland Harbor HI Sites, as shown on figures in Appendix F. Plots are available for the following metals: arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, and zinc (Figures F-1 through F-9, respectively). Of the metals, only concentrations of arsenic detected during the October 23, 2010 sampling event were elevated relative to concentrations found at other Portland Harbor HI sites. Concentrations of cadmium, noted in the December 14, 2009 DEQ comment letter as being elevated relative to Portland Harbor HI Sites, detected in samples from Basin L post-line cleanout were below the applicable SLV and were not elevated relative to other Portland Harbor HI Sites, as shown on the plot in Appendix F.

6.2 Phthalates

Samples collected from Basins L and M on October 23 and November 6, 2010, were analyzed for total and dissolved phthalates; samples collected on February 12, 2011 were analyzed for total phthalates. The results of the sampling, along with the 2007 sampling are shown in Table 2. As noted above, because incorrect filtration procedures were used for the October 23 and November 6, 2010 events, the dissolved phthalate concentration results for the October and November events were rejected and are not used in the evaluation of the post-cleanout sampling. Therefore, only the total phthalate concentrations will be evaluated in this section.

In general, concentrations of phthalates detected in Basins L and M decreased significantly following the line cleanout activities, as shown in Table 2 and Figure F-10 in Appendix F.

Phthalates with concentrations that exceed SLVs during one or more of the 2010/2011 sampling events are the following:

- Di-n-octyl phthalate in Basin M detected during the October 23, 2010 event. Di-n-octyl phthalate was not detected in the samples collected from Basin M during any other storm events (including the 2007 results) or in Basin L; and
- BEP detected in Basin L.

The one-time detection of di-n-octyl phthalate from Basin M is likely due to the variable nature of storm water samples and not indicative of an ongoing exceedance, as demonstrated by the non-detect results for the November 2010 and February 2011 sampling events (and the 2007 sampling events).

As noted previously, the DEQ concluded in their December 14, 2009 comment letter that the pre-line cleanout concentrations of phthalates were within the range of other Portland Harbor HI Sites, with the exception of BEP in Basin L. The total BEP concentrations before and after the line cleanout SCM were added to the plot showing the detected BEP in storm water for other the Portland Harbor HI Sites. The concentration of BEP detected following the line cleanout was within the typical range of other Portland Harbor HI Sites (Figure F-10; Appendix F). Additionally, concentrations of BEP detected in storm water in Basin L have decreased significantly from the pre-cleanout results (ranging from 7.0 to 10 µg/L) to the post-cleanout results (2.5 to 3.0 µg/L; Appendix F and Table 2).

6.3 Polychlorinated Biphenyls

Storm water samples were collected for total and dissolved PCB aroclor and congener analysis from Basin L, Basin M, and Basin Q. The filtration for the dissolved PCB analyses was performed incorrectly, and thus, the dissolved results were rejected and are not included in this evaluation. No SLVs are available for individual PCB congeners, thus congener data was evaluated based on total PCBs. Additionally, no DEQ plots are available for PCB aroclors, so only the PCB congener concentrations are evaluated against data from other Portland Harbor HI Sites.

PCB Aroclors. PCB aroclor concentrations detected in samples collected from Basins M and L decreased following the line cleanouts, as shown in Table 3. The Basin Q results were consistent or lower than results detected prior to the Cargill Tank Demolition work.

No PCB aroclor concentrations for Basins L or M exceeded SLVs following the line cleanout. Prior to the line cleanouts in Basin L and M, a number of PCBs were detected at concentrations exceeding SLVs. For Basin Q, the concentration of Aroclor 1254 detected in the May 11, 2011 sample slightly exceeded the SLV. The SLV is 33 nanograms/liter (ng/L) and the detected concentration was 38 ng/L.

PCB Congeners. As shown in Table 4, the total PCB congener concentrations for Basins L and M decreased following the line cleanout SCM, though the difference between the pre- and post-cleanout results is more significant in Basin M. For Basin Q, the PCB congener concentrations were slightly less than concentrations prior to the grain tank demolition activities.

The total PCB concentration detected in samples collected from Basins L and M during the 2010/2011 sampling exceed the JSCS SLV for total PCB congeners (Table 4). Similarly, the total PCB concentration detected in the sample collected from Basin Q also exceeded the JSCS SLV for total PCB congeners.

Although the JSCS SLV for total PCB congeners was exceeded, the total PCB concentrations detected in Basins L, M, and Q were within the typical concentrations detected in other Portland Harbor HI Sites, as shown on Figure F-11 in Appendix F.

6.4 Polycyclic Aromatic Hydrocarbons

Samples for total and dissolved PAH analyses were collected from Basins L and M on October 23 and November 6, 2010, and February 12, 2011. Similar to other analytes, the filtration of the dissolved samples was performed incorrectly, and the dissolved data were rejected and are not used in this evaluation.

Post-cleanout concentrations of PAHs and total PAHs were generally less than the pre-cleanout concentrations in both Basins L and M, though the difference in concentrations was more significant in Basin L. Pre-SCM 2007 total PAH concentrations in Basin L ranged from 10.0 to 37.0 ug/L, whereas post-SCM total PAH concentrations detected in 2010/2011 ranged from 1.5 to 4.8 ug/L.

The 2010/2011 total PAH results exceeding the JSCS SLVs are presented in Table 5. As shown in Table 5, a number of detected PAH concentrations exceeded the JSCS SLVs.

The total PAH concentrations detected in samples from Basins L and M were plotted with the other Portland Harbor HI Sites, and concentrations were within the range detected in other Portland Harbor HI Sites, as shown on Figure F-12 in Appendix F.

6.5 Total Suspended Solids

The samples collected on October 23, November 6, and February 12, 2011, were analyzed for TSS (Table 6). As anticipated, TSS concentrations post-line cleanout were significantly less than concentrations detected pre-cleanout, indicating that the cleanouts were successful at removing solids in the conveyance lines. The Basin L TSS concentrations detected during 2007 ranged from 80 to 309 mg/L and were consistently the highest observed across the storm water basins at Terminal 4. The Basin L TSS concentrations detected during the 2010/2011 sampling ranged from 7 to 28 mg/L. Similarly, though the 2007 TSS results for Basin M were not as high, the range of the TSS concentrations dropped from 39 to 117 mg/L in 2007 to <1 to 9 mg/L in 2010/2011.

The post-cleanout TSS results are within the typical range of TSS concentrations for Portland Harbor HI Sites, as shown on Figure F-13 in Appendix F.

7.0 Analysis and Conclusions

Below is an analysis of the effectiveness of the SCMs (i.e., line cleanouts) performed in Basins L and M and an analysis of the effectiveness of the BMPs employed during the grain tank demolition at Basin Q.

7.1 Line Cleanouts – Basins L and M

The order of magnitude decrease in TSS concentrations and overall downward trend of constituent concentrations, including significant decrease in most constituent concentrations (discussed in Section 6), demonstrate that legacy solids was a contributor to the pre-cleanout exceedances of SLVs and support that the cleanouts successfully removed this source. As detailed in the SW DSR, surface soil at the facility does not appear to be a source to storm water. Concentrations of constituents detected in Basins L and M are largely within the typical range of concentrations of other Portland Harbor HI Sites and/or below SLVs. Therefore, no further SCMs beyond the BMPs already employed by the Port are recommended for Basins L and M.

As noted in Sections 3 and 4, the conveyance lines of Basins N and K were also cleaned due to similar land uses between Basins N and K and Basins L and M, as described in the Rationale Memorandum (Ash Creek, 2007c). Results of the post-cleanout storm water sampling at Basins L and M support that no further SCMs beyond the BMPs already employed across Terminal 4 (including the filter fabric inserts installed in Basin N catch basins) are recommended for Basins N and K.

7.2 Tank Demolition BMPs – Basin Q

As discussed in Section 6, the total PCB aroclors and congener concentrations detected in the 2010/2011 samples collected from Basin Q were not greater than concentrations detected during the original sampling, prior to the demolition of the Cargill grain tanks. As detailed in the Demolition Report, strict precautions were taken during the tank demolition to prevent material from the demolition, including PCB-containing paint chips, from entering the storm water system. Total PCB congener concentrations detected during both the previous sampling events and 2010/2011 sampling events exceed the SLV, but are at the low end of the Portland Harbor HI Sites typical total PCB concentrations (Appendix F).

As described in Section 2, strict BMPs are employed across Terminal 4 and the Slip 1 and Slip 3 Upland Facilities. In addition, filter fabrics are present in Basin Q catch basins that surround the former grain tanks. The filter fabric was installed during March 2008 (following the storm water sampling program) and has been added to the Port's standard BMPs of regular cleaning and servicing.

Based upon the current BMPs, the catch basin inserts, the limited current land use of the basin, and the comparison of the results before and after the grain tank demolition in Section 6, no further source control is needed in this basin.

7.3 Conclusions

The following provides conclusions drawn from the storm water evaluation sampling program and storm water source control program implemented at the Terminal 4 Slip 1 and Slip 3 Upland Facilities:

- As described in the Rationale Memo, basins Q, R, L, M, and D were selected for storm water sampling (Ash Creek/Newfields 2007c). The smaller, mostly pervious, or inaccessible drainage basins were selected for extrapolation from the basins selected to be sampled. Based on the results of the 2006 to 2008 sampling of Basins Q, R, L, M, and D, it was concluded that no additional SCMs were needed for Basins Q, R, and D (Ash Creek, 2009c). Because there are no apparent constituents in surface soil at the Facilities that would be impacting storm water, a line cleanout of the conveyance systems for Basins L and M (and extrapolated basins N and K) was conducted to remove legacy solids from the lines. Additional sampling of storm water from Basins M and L was conducted in October 2010 through February 2011 to verify the effectiveness of the line cleanouts. Additional sampling of Basin Q was requested by the DEQ to verify that the grain tank demolition activities had not impacted storm water and was conducted in October 2010 through May 2011.
- The results of the 2010-2011 storm water sampling for Basins M and L demonstrates that the storm water line cleanouts successfully removed legacy solids from the conveyance lines. The TSS concentrations were significantly reduced in the post-cleanout samples (previously correlated with detected chemical concentrations). Concentrations in storm water from Basins L and M following the line cleanout are within the range detected in other Portland Harbor HI sites.
- The results of the 2010-2011 storm water sampling for Basin Q demonstrates that storm water has not been impacted by the demolition of the grain tanks conducted in 2008, following the initial 2006-2008 storm water sampling program. Concentrations of PCBs detected in storm water from

Basin Q are equal to or less than the concentrations detected during the original sampling and are within the range detected in other Portland Harbor HI Site.

Results of the storm water sampling program show that concentrations of constituents in storm water are now within the range detected at other Portland Harbor HI Sites. No further characterization or SCMs are recommended for the Facilities.

8.0 References

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